

Manchester: A City of Trees

A Survey of Street Trees in Manchester, New Hampshire

*Implemented by the NH Community Tree Steward Program
Sponsored by UNH Cooperative Extension
in partnership with the NH Division of Forests and Lands
and the Society for the Protection of NH Forests*

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Tree Survey Highlights

- Manchester has 50,000 street trees with an estimated value of \$128 million dollars.
- Seventy one per cent of all the street trees throughout the city are in good to excellent condition. The survey shows, however, that the condition of trees varies greatly among the following four zones studied: Business District, Center City and West Side Areas, the North End, and Outer Neighborhoods.
- Street trees in the Outer Neighborhoods are in the best condition with 81% in the good to excellent category. The Center City, West Side Areas, and Business District have less than 50% of their trees in good to excellent condition.
- Based on their current health, over half the trees in the Center City, West Side Areas, and the Business District won't survive for more than ten years. A long-term management program needs to be established immediately to help them survive.
- Fifty per cent of all street trees throughout Manchester are 1-8 inches in diameter. In the Business District, 81% of all street trees are also 1-8 inches in diameter. Of these smaller trees, 61% were only in fair to poor condition. It appears there may be problems getting young trees established in the Business District.
- The North End had the greatest number of mature trees. Fifty nine per cent were 9 inches or greater. Many of these trees have grown from seed and lack desirable characteristics of nursery-grown trees. The North End has the greatest need for mature tree care.
- There are 61 species of street trees represented throughout the city. Red maple, a native species, has the greatest amount at 13%. Norway maple, an exotic and invasive species, has 12%. These two species exceed the recommended 5%-10% limit of any single tree species within a community.
- Throughout the city, there are an estimated 14,731 good to excellent planting sites along city streets. The Business District, the only area with limited sites, may have to consider the following options: plant smaller tree species where space is limited, improve the planting beds, plant fewer trees, and/or require future planting beds meet a set standards.
- An estimated 2,000 public and private street trees are in poor condition and will need to be removed in the next five years. Planting 250 street trees each year for the next ten years can replace anticipated losses.
- In comparison to a 1989 survey, the amount of street trees in Manchester has decreased by approximately 10,000, and the conditions of street trees have deteriorated from approximately 86% (in healthy condition) to 71%. This coincides with the decrease in the tree maintenance budget due to city budget constraints in the 1980's and 90's.

Introduction

During 1997, the New Hampshire Community Tree Steward Program, in partnership with Manchester Parks and Recreation Department, conducted a statistical survey of the street trees in the City of Manchester to determine the overall health, species distribution, and maintenance requirements of Manchester's Urban Forest. The survey also included collection of data pertaining to available planting sites for trees.

Rationale

This survey is a statistically accurate method of estimating the species composition of an urban street tree population quickly, and accurately, with an acceptable level of error. A complete stem-by-stem tree inventory is expensive and time consuming. Furthermore, managing a full database and updating it over the years requires additional resource allocation. This partial inventory based on stratified random sampling, is an affordable and practical way of establishing a database of urban street tree information for a community.

For Manchester, a city with a minimal tree budget, this type of inventory can provide information essential to develop a citywide tree management plan. This method provides the following information: species composition, diameter class, health, total number of street trees, and number of potential planting sites. Data collected provides a means for statistically accurate detection of general patterns and trends in street tree populations, such as overplanting of a particular species.

Method

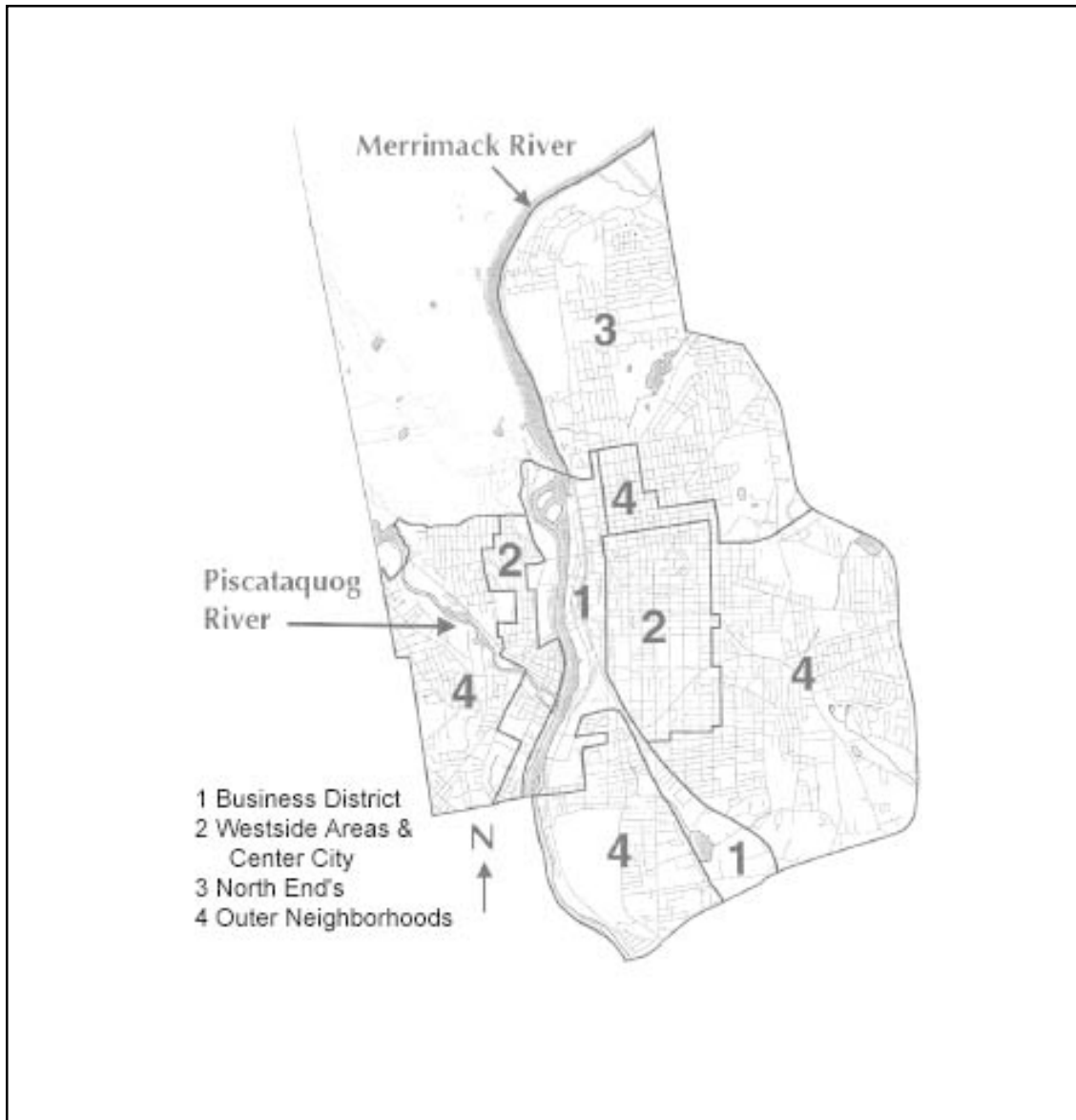
A Statistical Method for the Accurate and Rapid Sampling of Urban Street Tree Populations published by R. Jaenson, N. Bassuk, S. Schwager, and D. Headley (Journal of Arboriculture, July 1992) was the survey model used. This method used published and peer-reviewed research which was demonstrated as accurate in research conducted in four New York cities of varying sizes. The method consists of four steps:

- 1) establishing zones
- 2) surveying a pre-sample of trees
- 3) surveying at least 2000 trees (distribution based on pre-sample)
- 4) data analysis.

Zones

The City of Manchester was divided into four zones based on land use patterns, canopy cover, and development patterns (Table 1). Many neighborhoods were distributed within these zone classifications but no neighborhood crossed zone boundaries. The zones were designated as follows:

Table 1: Manchester Tree Inventory Zones



#	Zones	Areas Covered
1.	Business District	Downtown (west of Pine Street), and the South Willow Street area.
2.	Center City and West Side Areas	North of Cilley Road to Orange Street, and west of Belmont to Pine Street, On the West Side: east of Main and Dubuque Streets.
3.	North End	Webster Street north, and north and west of Derryfield Park.
4.	Outer Neighborhoods	Surrounding neighborhoods on both the East and West Sides.

Tree Survey Pre-sample

The pre-sample estimated the number of trees in each zone and throughout the city. A boundary of twenty feet from the edge of the street was established. Both publicly owned and privately owned trees were included in the pre-sample and the full survey. (Twenty feet was chosen because Manchester has no standard right-of-way setbacks which varied from street to street.) In the pre-sample, trees were counted to determine the number of trees per block. Species were not recorded in the pre-sample. Data collected in the pre-sample helped determine how many blocks to count in each zone for the full 2,000 tree survey.

Method

Every block in each zone was numbered on a map and several blocks in each zone were randomly chosen (random number generation) to be surveyed. Blocks were surveyed by driving around the block and counting the street trees on the interior of the block. (This same windshield method was used in the full 2,000-tree survey, except more data was collected.) From this pre-sample, an average number of trees per block were determined and this was extrapolated to estimate how many trees were in each zone and thus, the city.

Results

Approximately 1311 trees were surveyed in the pre-sample of 64 blocks throughout the city of Manchester (Table 2). Results from this pre-survey determined an estimate of 38,658 trees in the twenty-foot setback. To conduct a full 2,000-tree survey, 64 blocks needed to be surveyed.

Table 2: Pre-sample Results by Zone

Zones	Pre-Sample						Need to Sample	
	# Blocks	#Blocks (Pre)	# Trees (Pre)	#Trees/Block	Est. # Trees	% Trees	# Trees	#Blocks
Business District	92	10	156	15.60	1,435.2	3.7%	80	5
Center City/ West Side Areas	290	10	125	12.50	3,625	9.3%	180	14
North End	223	10	679	67.90	15,141.7	39.1%	780	12
Outer Neighborhoods	631	12	351	29.25	18,456.75	47.7%	960	33
	1,236	42	125.25	—	38,658.65	100%	2,000	64

2,000 Tree Survey Method

Data collected in the pre-sample showed the number of blocks to be surveyed in each zone. Again, these blocks were chosen through a random number generation computer program developed by Tree Steward, Ed Smith. The interior circumference of each block was surveyed and data collected on a tally sheet. Species were identified, along with their diameter class and overall condition. Table 3 shows how condition classes were categorized. Condition was represented by classifying trees into four condition classes (excellent, good, fair, and poor). Potential tree planting sites were also tallied, along with their size and condition. Vacant sites were identified within 20 feet from the edge of the pavement. Potential tree planting sites are described further beginning on page 18.

Table 3: Conditions of Trees

Condition	Description
Excellent:	Perfect specimen. Excellent form and vigor for species. No pest problems or mechanical injuries. No corrective work required. Minimum life expectancy - 30 years.
Good:	Healthy and vigorous. No apparent signs of insect, disease, or mechanical injury. Little or no corrective work required. Representative of the species. Minimum life expectancy - 20 years.
Fair:	Average condition and vigor for area. May need corrective pruning or repair. May lack desirable, characteristic form. May show minor insect, disease or physiological problems. Minimum life expectancy - 10 years.
Poor:	General state of decline. May show severe mechanical, insect, or disease injury, but death is not imminent. May require major repair or renovation. Minimum life expectancy - 5 years.
Dead/Dying:	Dead, or death imminent within 5 years.

A total of **2,977** trees or 6.4% of the street trees within 20 feet from the edge of the pavement were sampled in 64 city blocks. Table 4 reflects the numbers of trees sampled.

Table 4: Number of Trees Surveyed by Zone

	# of trees	% of total
Business District	363	12.2
Center City, West Side Areas	185	6.2
North End	744	24.9
Outer Neighborhoods	1,685	56.6
Total	2,977	100

Manchester Tree Survey Results

Value of Manchester's Street Trees

Based on the data collected, the total estimated number of trees within 20 feet from the edge of pavement was **46,924**, with a total value of **\$127,875,000**. This dollar figure is based on replacement cost, the size of each tree, and the species distribution. Jane Calvin, Action Forester of the Massachusetts Department of Environmental Management, compiled the data to determine the estimated dollar value. The program used for calculations was the *Tree Inventory System* developed by the University of Nebraska and the Nebraska Forest Service Community Forestry Program.

Overall Tree Conditions

Throughout the city, 71% of trees were in good to excellent condition. Twenty nine per cent of the trees were in fair to poor condition and need immediate attention. Although this statistic looks reasonably good, there are wide disparities throughout the city (Table 5).

In two zones, the Center City/West Side Areas, and the Business District, over half of the trees (52 - 55%) were in fair to poor condition and not likely to survive for more than ten years. Establishing an immediate care and long term maintenance program will help ensure their survival. While many Business District and Center City trees were in distress, the Outer Neighborhoods had the healthiest trees with 81% in good to excellent condition, followed by the North End with 65% in good to excellent condition.

Table 5: Tree Condition Totals

Zones	# and % of Trees Observed	Categories							
		# Excellent	% Excellent	# Good	% Good	Fair	% Fair	# Poor	% Poor
Business District	185	1	0.5%	83	44.9%	87	47.0%	14	7.6
Center City/ West Side Areas	363	11	3.0%	161	44.4%	146	40.2%	45	12.4
North End	744	132	17.7%	357	48.0%	207	27.8%	48	6.5
Outer Neighborhoods	1685	505	30.0%	858	50.9%	263	15.6%	59	3.5
Total Trees Observed	2977 (100%)	649	21.8%	1459	49.0%	703	23.6%	166	5.6

Developing a Management Plan

Manchester does not currently have a tree management plan. The information from this survey can help the city to develop a city-wide management plan for its trees. According to a 1989 USDA Forest Service report, a management plan supports budget requests by linking expenditures to specific management activities such as identifying specific locations scheduled for tree planting, pruning, and removals. A management plan is critical for developing, sustaining, and maintaining the urban forest.

Tree Species Condition by Zone

Business District

The Business District had the largest percentage of trees in fair or poor condition with only 44% in good condition and .05% in excellent condition. Norway maple was the most common species found in the Business District. Of 35 individual trees sampled, only 16 were in good condition. Other species were in better condition. Table 6 shows those species with more than 50% of their population in good condition.

Table 6: Business District Trees Species in Good to Excellent Condition

Species	%
red maple	100
pin oak	76.5
green ash	60.5

Table 7 shows trees with 50% or more in fair to poor condition. This does not include all tree species that might do poorly, but only those species viewed in the inventory in sufficient quantities to be measured.

Table 7: Business District Trees Species in Fair to Poor Condition

Species	%
white birch	100
white pine	88.9
honey locust	72.2
Norway maple	54.3
silver maple	50.0

Center City/West Side Areas

Tree species in the Center City/West Side Areas also had a large percentage of trees in fair or poor condition, at 52%. Again, Norway maple was the most common species found in this zone with 57% in fair or poor condition. Table 8 shows those species with 50% or more in good condition.

Table 8: Center City and West Side Area Tree Species in Good to Excellent Condition

Species	%
pin oak	87.5
honey locust	87.5
green ash	83.3
spruce	62.0
fruit	57.9
American elm	57.1
arborvitae	53.8
little leaf linden	52.9

Table 9 indicates those species with 50% or more of the trees in fair to poor condition. This does not include all species that might do poorly, but only those observed in the sufficient quantities to be measured.

Table 9: Center City and West Side Area Tree Species in Fair to Poor Condition

Species	%
ailanthus	100
white birch	100
boxelder	90.4
gray birch	71.5
silver maple	64.3
white ash	60.0
cherry	57.2
Norway maple	56.1
red maple	51.6

North End

In Manchester's North End, 66% of the trees were in good to excellent condition. Trees in the North End had more growing space than those in the previous two zones. Improved growing conditions was the likely reason why all tree species observed were doing well with the exception of white birch. Reasons for the poorer health of the white birch were not documented. However, it is significant that in three of the four zones, white birch was not doing as well as other species.

Outer Neighborhood

Trees in Manchester's Outer Neighborhoods were in the best condition with 81% of the trees in good to excellent condition. Less stress factors seemed to be present in this area of the city and all tree species observed were doing well with the exception of willows. The reason for the poorer condition of the willows was not documented. The Outer Neighborhoods was the only zone that had willows in significant enough numbers to record.

Tree Size Class by Zone

City-Wide

Fifty per cent of all street trees in the city were from one to eight inches in diameter (Table 10). Forty two per cent of all street trees were beginning to reach maturity and were between 9 and 24 inches in diameter. Seven per cent of street trees were in the larger size classes of 25 inches in diameter or greater. Of this 7%, about 2% will need to be carefully monitored for potential hazards since they were in fair or poor condition.

Business District

In the Business District, 81% of the trees were one to eight inches in diameter. Of these smaller trees, 61% were in fair or poor condition, and 38% in good condition. There appears to be a problem establishing young trees. If trees survived and increased in size, their condition would likely improve.

Nineteen per cent of the trees in the Business District had grown beyond eight inches in diameter. These larger trees included silver maple, Norway maple, green ash, pin oak, and red maple. With so few trees in the larger size classes, there needs to be more attention given to young trees. Improving site conditions such as larger planting beds, and providing protection from soil compaction and mechanical injury are needed. Young trees also require regular care during their first years. With minimal training, residents and businesses could provide this type of care for trees in close proximity.

Center City/West Side Areas

In the Center City/West Side Areas, 54% of the trees were one to eight inches in diameter, and 30% were 9 to 16 inches in diameter. Of the smallest trees, 49% were in fair or poor condition, and of the trees 9 to 16 inches in diameter, 80% were in fair to poor condition. More than half the trees in the larger size classes were also in fair to poor condition.

The youngest trees in the Center City/West Side Areas are comparatively in the best condition with 48% in good condition and 1.5% in excellent condition. Approximately one-half of the young trees will survive for more than 10 years. The predicted rate of survival decreases for trees in the larger size classes with the average of only 29% of trees surviving for 10 or more years.

These large percentages of trees in fair or poor condition in the Center City/West Side Areas suggests the need to establish volunteer and city maintenance programs for trees in all class sizes. Improving site conditions, such as larger planting beds and protection from soil compaction and mechanical injury, is needed.

North End

The North End had the greatest percentage of mature trees with about 59% greater than one to eight inches. Of these trees, many are native species. Trees which have self-seeded (and some that have not) have desirable characteristics of nursery grown trees. Therefore, the North End has a great need for mature tree care. Much of this type of care needs to be provided by trained and insured tree care professionals who have the experience and equipment to deal with large branches and tree removal.

Outer Neighborhoods

The Outer Neighborhoods had the second greatest percentage of mature trees with 50% having a diameter of 9 inches or above. A professional maintenance program is needed for these mature trees, while property owners or volunteers can be trained to care for the smaller trees.

Table 10: Tree Size Class by Zone and Diameter

Zones	1-8 inches	9-16 inches	17-24 inches	25-32 inches	32+ inches	Totals
Business District	150	17	9	8	1	185
Center City & West Side	194	109	37	13	10	363
North End	303	244	165	28	5	744
Outer Neighborhoods	850	438	250	97	50	1685
Totals	1497	808	461	146	66	2977
% Totals	49.9%	27.1%	15.4%	4.9%	2.2%	100%

Species Composition

Species Composition — City-Wide

Throughout the city, the street tree population was represented by 61 species. Red maple, a native species, was found in the greatest number totaling 13% of the total species observed. The second highest, at 12%, was Norway maple, an exotic species which is invasive to natural areas. Although 11% of the trees were in the spruce family, this percentage included several individual species, such as Colorado blue, Norway, and the native species - white and red spruce (Table 11).

Although there was good diversity of trees in the city, urban forestry professionals recommend a 5 – 10% ceiling of any single tree species. Red maple and Norway maple have exceeded this limit. Spruce doesn't exceed the recommendations since the 11% total represents more than one species. Another recommendation designed to promote a healthy, diverse urban forest is that no family make up more than about 30% of the total population. Of the 2977 trees sampled, 33% of all the street trees were in the maple family. The maple family is the only family to exceed the 30% ceiling. Other families fall far below the 30% limit (Table 12).

Table 11: Individual Tree Species that Represent the Largest Populations Throughout the City

red maple	13%
Norway maple	12%
spruce (sp.)	11%
red/black oak	7%
fruit (sp.)	5%
white pine	5%
arborvitae	5%
sugar maple	4%
silver maple	4%

Note: All other species observed were in numbers of less than 4%.

Fifty-four percent of the total trees observed were in the three genus, maple, spruce, and oak and represented approximately 12 species out of the 61 total.

Table 12: Genus of Species in the Greatest Numbers.

Maple Genus

red	13%
Norway	12%
sugar	4%
silver	4%

Total 33% Maple Genus

Spruce Genus

The inventory did not distinguish between individual species of spruce. Individual species that were observed but not noted separately include Colorado blue, Norway, white, and red.

Total 11% Spruce Genus

Oak Genus

red/black	7%
white	2%
pin	1%

Total 10% Oak Genus

Species Composition within Zones

Species composition was found to be different within each zone. For example, although red maple had the greatest number of trees throughout the city, it was not the dominant species in each zone. In fact, red maple was only found to make up 3% of the street tree population in the Business District, while in the Outer Neighborhoods it was the most dominant species at 15%. By looking at the species composition in each zone, specific recommendations can be given for future plantings on a zone by zone basis.

■ Species Composition – Business District

The data in Table 13 shows which species have reached or are near the 10% limit in the Business District. Norway maple, the most dominant tree, is an exotic species with invasive tendencies in natural areas.

Table 13: Dominant Species in the Business District

Species	% in zone	% in good to excellent condition
Norway maple	17	45.7
little leaf linden	10	45.0
honey locust	09	27.8
pin oak	08	76.5

Table 14 lists recommended species that could be used in future plantings in the Business District. These recommendations for the Business District are based on the species condition data in conjunction with species composition. *The recommended trees are not the only species that should be planted in the Business District but have shown the best results in the area and have not reached the 10% limit.*

Table 14: Recommended Trees to be Planted in the Business District

- red maple
- green ash
- *Consult publication for others

*For an extensive list of species that could adapt well to stressful conditions present in the Business District, consult the publication: *Selecting Trees for Urban Landscape Ecosystems* by Mary K. Reynolds and Raymond M. Boivin. Contact the NH Division of Forests and Lands, P.O. Box 1856, Concord, NH 03301.

Table 15 lists trees that should not be planted in the Business District due to over-planting, or poor condition of existing trees of this species. This doesn't include all species that would do poorly, but only those observed in sufficient quantities to measure.

Table 15: Species Not Recommended for Further Planting in the Business District

<u>Deciduous Species</u>	<u>Evergreens</u>
Norway maples	white pine
honey locust	hemlock
little leaf linden	
white birch	

■ Species Composition – Center City/West Side Areas

Table 16 shows which species have reached or are near the 10% limit in the Center City/West Side Areas. Norway maple is the most dominant tree. Table 18 lists trees that shouldn't be planted in the Center City or West Side Areas due to over planting, or the poor condition of existing trees of this species. This doesn't include all species that would do poorly, but only those observed in sufficient quantities to measure.

Table 16: Dominant Species in the Center City/West Side Areas

Species	% in zone	% in good to excellent condition
Norway maple	16	44
spruce sp.	14	62
sugar maple	10	51
red maple	09	49
arborvitae	07	54

Table 17 shows recommended species that could be used in future plantings in the Center City/West Side Areas. These recommendations are based on the species condition data in conjunction with species composition. The recommended trees are not the only species that should be planted, but have shown the best results in the Center City/West Side Areas and have not reached the 10% saturation limit.

Table 17: Recommended Trees to be Planted in the Center City/West Side Areas

<u>Deciduous Species</u>	<u>Evergreens</u>
pin oak	Austrian pine
little leaf Linden	
green ash	
honey locust	

Table 18: Trees That Should not be Planted in the Center City/West Side Areas

<u>Deciduous Species</u>	<u>Evergreens</u>
Norway maple	hemlock
sugar maple	white pine
silver maple	
white birch	
gray birch	
boxelder	
ailanthus	
white ash	
cherry	

■ Species Composition — North End

The species composition in the North End is different from the Business District and Center City/West Side Areas. Native species such as red and black oak, white pine and red maple dominate the area. Many of these trees weren't planted but were part of the existing landscape. The fourth most abundant species, however, was Norway maple, an exotic species that can be invasive. Since it has reached 10% saturation in this zone and because of its invasive tendency, this is the one tree species not recommended for further planting.

Based on the inventory figures in conjunction with overall species composition most tree species that are hardy for northern New England should do well in Manchester's North End, (assuming the trees have adequate growing conditions).

■ Species Composition – Outer Neighborhoods

This zone was the largest in the inventory with the greatest number of trees and greatest species diversity. It is important to point out how different the tree conditions were in this area. No other zone had so many trees in such good condition. The three most numerous species in the zone were red maple, spruce, and Norway maple. Red maple and some spruce species are native to New Hampshire. Table 19 indicates which species reached or are near the 10% limit in the Outer Neighborhoods. Table 20 lists trees that should not be planted in the Outer Neighborhoods due to the size of the existing populations.

Table 19: Dominant Species in the Outer Neighborhoods

Species	% in zone	% in excellent and good condition
red maple	15	74
Norway maple	12	74
spruce (sp.)	12	90
arborvitae	8	96
fruit (sp.)	6	82
red/black oak	5	88

Table 20: Species Not Recommended for Further Planting:

red maple
Norway maple
arborvitae

Based on the inventory figures in conjunction with overall species composition, most tree species that are hardy for northern New England should do well in Manchester's Outer Neighborhoods. This assumes that each species has adequate growing conditions.

■ Summary of Species Distribution within Zones

The Outer Neighborhoods had the greatest diversity of species while the North End of Manchester had the greatest amount of native species and natural wooded areas. The other two zones had more exotic species than native. Ecologically it is important to plant native species whenever possible. In highly stressed and disturbed areas (found in the Business District and Center City/West Side Areas) many native species would have less chance of survival than some exotics species. When exotic species are chosen, it is important to know which species have invasive tendencies, so those species aren't chosen.

Due to overplanting and the invasive nature of Norway maple, this species is not recommended for planting in any area of Manchester. White birch, a native species, is struggling in three zones out of four. It is a species sensitive to urban stresses including poor air quality. Proper site selection and extra care should be given for any future planting of this species. Willow species were only found in measurable numbers in the Outer Neighborhoods. It was the only species in this zone that had the majority of trees in fair condition. Willow grows naturally in wet areas. It has brittle wood and breakage occurs frequently. It is not recommended to plant in streetscapes.

Of the 61 species found in the city, many have not been discussed in this report due to their small numbers. Many of these species would be suitable for future plantings and would increase the diversity of the urban forest. The appendices lists all species found by zone and their condition. For future plantings, consult these species lists and compare with recommendations set forth in *Selecting Trees for Urban Landscape Ecosystems: Hardy Species for Northern New England Communities*, by Mary K. Reynolds and Raymond M. Boivin. This publication lists both native and exotic species suitable for planting in Manchester.

The condition of many species varied within the zone. Many species such as white pine and hemlock were found to do well in the North End and Outer Neighborhoods while they were in poorer condition within the Business District, and Center City/West Side Areas. Through observation of the overall growing conditions within each zone, there are significant differences. Trees in the Business District and Center City/West Side Areas have less space, and tend to be under more stress. Trees in the Outer Neighborhoods and the North End typically have more space and as a result are in better condition. These environmental and site condition factors absolutely need to be considered when choosing species for future plantings in all areas of the city.

Maintenance Needs

There is a great need to concentrate on the care and maintenance of trees within all city zones. Twenty nine per cent, or an estimated 13,600 trees, require early intervention to avoid future removal costs and pedestrian hazards. Without immediate intervention, the amount of tree removal alone will cost the public and private sectors many thousands of dollars. To manage such great numbers it is necessary to review the amount of maintenance required in each zone and prioritize them as vast differences were found between zones.

In all, an estimated 2,500 trees throughout the city (5.5% of the public or privately owned street trees) were in poor condition and need monitored carefully for hazards. They will probably need to be removed within the next five years. Fortunately, of these trees only, less than one per cent (or an estimated 27 trees) have a diameter greater than 25 inches. When large trees need to be removed, the cost is greater.

Center City/West Side Areas

According to the percentages of poorer quality trees per zone, top priority should be given to trees in the Center City/West Side Areas where 52% of the trees were in fair or poor condition. Trees in this zone tend to receive the least amount of attention. The two-person city tree crew has time to deal only with city-wide tree emergencies.

Business District

Trees in the Business District were in need of care and maintenance since 55% were in fair or poor condition. Fortunately, trees in the Business District are coming to the attention of the business community through the efforts of Intown Manchester Incorporated and the For Manchester

organization. At this time there still is no management plan developed for tree care and maintenance. It is recommended that the business community work with the Manchester Tree Committee and Manchester Parks and Recreation to develop a plan.

North End

In the North End, 27% of the trees observed were in fair condition and need immediate care in order to survive the next ten years. This is an estimate of 3,167 trees under public and private ownership.

Outer Neighborhoods

In the Outer Neighborhoods, 15.7% of all trees observed were in fair condition. (This estimates 4170 trees under public and private ownership.) Immediate care is needed to avoid excessive removal and replanting costs.

Planting Sites Throughout the City

An estimated 2,300 public and private trees in poor condition will need to be removed within the next five years. The removal of these trees needs to be arranged through a management plan. Planting 250 trees each year for the next ten years can replace the anticipated losses. The survey included a count of vacant planting sites. Table 21 describes planting sites and Table 22 indicates the distribution and condition of vacant planting sites within each city zone.

Table 21: Planting Site Description

Condition	Description
Excellent:	For vacant planting spaces no overhead wires or sidewalks.
Good:	For vacant planting spaces sidewalk present, but no overhead wires.
Fair:	For vacant planting spaces both wires and sidewalks present.
Poor:	For vacant planting spaces, requires cement cutter, otherwise in good condition (no overhead wires).

Table 22: Planting Spaces Within 20' of Streets

Zones	Exc.- Good Sites	Spaces/ Block	Blocks/ Zone	Spaces/ Zone	Fair-Poor Sites	Spaces/ Block	Blocks/ Zone	Spaces/ Zone	Total Spaces
North End	93	7.75	223	1728.25	5	.4	223	89.2	
Outer Neighborhoods	524	1.8	631	9969.8	53	1.6	631	1009.6	
Business District	23	4.6	92	423.2	24	4.8	92	441.6	
West Side Areas & Center City	127	9.0	290	2610	32	2.2	290	638	
Totals				14,731.25		+		2178.4	16,909.65

Planting Recommendations

The total number of *excellent to good planting sites* is estimated at 14,731. With the exception of the Business District, each zone has several *good to excellent planting sites* available. Therefore it is unnecessary at this time to consider planting trees in poorer quality sites. In the Business District there are more *fair to poor sites* than *good to excellent sites*. Therefore the following options must be considered for future planting in the Business District:

- Improve planting sites when possible.
- Plant small trees instead of large trees where space is limited. (While smaller trees provide less shade, many have attractive flowers and fruits and provide food for urban wildlife.)
- Plant fewer trees, and consider other aesthetic features where possible such as flower planters or benches.
- Require future planting spaces meet minimal standards.

The Business District lacks adequate planting space and is limited in comparison with the other zones in the city. To insure a healthy urban forest, it is vital to plant the right tree in the right space. Large trees planted under wires or in small pits will increase maintenance costs when trees die early due to their environment.

Manchester's Green Streets Program currently plants only medium to large shade trees. Smaller trees need to be planted where there are overhead wires or low soil volume. Small trees provide benefits such as wildlife habitat and aesthetic qualities and it is recommended that they be included in the Green Streets Program.

Over several years the Manchester Green Streets Program has enabled residents and businesses to plant trees. This program should continue and reviewed to increase its effectiveness. Suggestions include:

- Focus the program in areas of the city with fewer trees.
- Develop a component that would allow low-income residents to plant trees.
- Earmark funding for maintenance, perhaps by establishing a maintenance fund in initial costs.
- Develop a plan for maintenance.
- Have an official contract that includes tree care with owners.
- Provide educational information on care, maintenance, and the importance of healthy trees.

1989 Tree Survey Comparison

The NH Division of Forests and Lands completed a brief street tree survey of Manchester in 1989. Although these two surveys used different data collection methods, comparing the results shows a decline in both the numbers and quality condition of Manchester's street trees. The 1989 survey estimated 64,000 street trees. The 1998 survey shows a decrease in the number of trees by 10,000. Conditions of street trees have also deteriorated. Approximately 86% of the street trees were in healthy condition in 1989, while 1998 shows only 71% in healthy condition. Coincidentally this coincides with the decrease in Manchester's tree maintenance budget. Due to city budget constraints in the 80's and 90's, a tree maintenance crew of two was only able to manage emergency situations and was not able to do any preventative maintenance.

Notes

Appendices

BUSINESS DISTRICT: NUMBERS OF TREES BY SPECIES AND CONDITION

Species	# Trees	% Species in area	# Excellent	% Excellent	#Good	%Good	#Fair	%Fair	#Poor	%Poor
Norway maple	35	18.9%	0	0.0%	16	45.7%	17	48.6%	2	5.7%
Spruce sp.	22	11.9%	0	0.0%	7	31.8%	10	45.5%	5	22.7%
Little leaf linden	20	10.8%	0	0.0%	9	45.0%	9	45.0%	2	10.0%
Honey locust	18	9.7%	0	0.0%	6	33.3%	11	61.1%	2	11.1%
Pin oak	17	9.2%	0	0.0%	13	76.5%	4	23.5%	0	0/17
Green ash	9	4.9%	0	0.0%	5	55.6%	4	44.4%	0	0.0%
White pine	9	4.9%	0	0.0%	1	11.1%	8	88.9%	0	0.0%
Silver maple	8	4.3%	0	0.0%	4	50.0%	2	25.0%	2	25.0%
Fruit sp.	7	3.8%	0	0.0%	1	14.3%	5	71.4%	1	14.3%
Red maple	6	3.2%	1	16.7%	5	83.3%	0	0.0%	0	0.0%
Juniper	5	2.7%	0	0.0%	5	100.0%	0	0.0%	0	0.0%
White birch	5	2.7%	0	0.0%	0	0.0%	5	100.0%	0	0.0%
Sugar maple	4	2.2%	0	0.0%	3	75.0%	1	25.0%	0	0.0%
White ash	3	1.6%	0	0.0%	0	0.0%	3	100.0%	0	0.0%
Ornament. Maple	2	1.1%	0	0.0%	2	100.0%	0	0.0%	0	0.0%
Boxelder	2	1.1%	0	0.0%	1	50.0%	1	50.0%	0	0.0%
Siberian elm	2	1.1%	0	0.0%	0	0.0%	2	100.0%	0	0.0%
Dogwood	2	1.1%	0	0.0%	2	100.0%	0	0.0%	0	0.0%
Hemlock	1	0.5%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Alilanthus	1	0.5%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Cherry sp.	1	0.3%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Austrian pine	1	0.5%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
White poplar	1	0.5%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Beech	1	0.5%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Tulip tree	1	0.5%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Horse chestnut	1	0.5%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Totals	185		1		83		87		14	
%	100%		0.5%		44.9%		47.0%		7.6%	

CENTER CITY AND WEST SIDE AREAS: NUMBERS OF TREES BY SPECIES AND CONDITION

Species	# Trees	%Species in area	#Excellent	%Excellent	#Good	%Good	#Fair	%Fair	#Poor	%Poor
Norway maple	59	16.3%	1	1.7%	24	40.7%	26	44.1%	8	13.6%
Spruce (sp.)	50	13.8%	2	4.0%	29	58.0%	17	34.0%	2	4.0%
Sugar maple	37	10.2%	1	2.7%	18	48.6%	14	37.8%	4	10.8%
Red maple	33	9.1%	4	12.1%	12	36.4%	12	36.4%	5	15.2%
Arborvitae	26	7.2%	0	0.0%	14	53.8%	10	38.5%	2	7.7%
Boxelder	21	5.8%	0	0.0%	2	9.5%	15	71.4%	4	19.0%
Fruit (sp.)	19	5.2%	0	0.0%	11	57.9%	7	36.8%	1	5.3%
Little leaf linden	17	4.7%	0	0.0%	9	52.9%	6	35.3%	2	11.8%
Silver maple	14	3.9%	1	7.1%	4	28.6%	6	42.9%	3	21.4%
Pin oak	8	2.2%	0	0.0%	7	87.5%	1	12.5%	0	0.0%
American elm	7	1.9%	0	0.0%	4	57.1%	0	0.0%	3	42.9%
Ailanthus	7	1.9%	0	0.0%	0	0.0%	6	85.7%	1	14.3%
Cherry (sp.)	7	1.9%	0	0.0%	3	42.9%	2	28.6%	2	28.6%
Grey birch	7	1.9%	2	28.6%	0	0.0%	2	28.6%	3	42.9%
Green ash	6	1.7%	0	0.0%	5	83.3%	1	16.7%	0	0.0%
White ash	5	1.4%	0	0.0%	2	40.0%	3	60.0%	0	0.0%
Honey locust	8	2.2%	0	0.0%	7	87.5%	1	12.5%	0	0.0%
Hydranga	5	1.4%	0	0.0%	1	20.0%	3	60.0%	1	20.0%
Basswood	3	0.8%	0	0.0%	1	33.3%	1	33.3%	1	33.3%
Hemlock	3	0.8%	0	0.0%	1	33.3%	1	33.3%	1	33.3%
Austrian pine	3	0.8%	0	0.0%	2	66.7%	1	33.3%	0	0.0%
White birch	3	0.8%	0	0.0%	0	0.0%	2	66.7%	1	33.3%
Catalpa	2	0.6%	0	0.0%	1	50.0%	1	50.0%	0	0.0%
White pine	2	0.6%	0	0.0%	1	50.0%	1	50.0%	0	0.0%
Siberian elm	2	0.6%	0	0.0%	0	0.0%	2	100.0%	0	0.0%
Fir (sp.)	2	0.6%	0	0.0%	0	0.0%	2	100.0%	0	0.0%
Ornament. Maple	1	0.3%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Horse chestnut	1	0.3%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Mt. ash	1	0.3%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Black oak	1	0.3%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Red cedar	1	0.3%	0	0.0%	0	0.0%	0	0.0%	1	100.0%
European birch	1	0.3%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Cottonwood	1	0.3%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Totals	363		11		161		146		45	
%	100%		3.0%		44.4%		40.2%		12.4%	

NORTH END: NUMBERS OF TREES BY SPECIES AND CONDITION

Species	#Trees	%Species in area	#Excellent	%Excellent	#Good	%Good	#Fair	%Fair	#Poor	%Poor
Red/Black oak	119	16.0%	12	10%	63	53%	33	28%	11	9%
White pine	103	13.9%	19	18%	54	52%	30	29%	0	0%
Red maple	99	13.3%	14	14%	42	42%	31	31%	12	12%
Norway maple	74	10.0%	19	26%	33	45%	16	22%	6	8%
Spruce (sp.)	51	6.9%	15	29%	11	22%	24	47%	1	2%
Red pine	32	4.3%	15	47%	12	38%	3	9%	2	6%
Silver maple	30	4.0%	1	3%	16	53%	13	43%	0	0%
White oak	30	4.0%	4	13%	15	50%	8	27%	3	10%
Sugar maple	30	4.0%	5	17%	16	53%	6	20%	3	10%
White birch	29	3.9%	2	7%	7	24%	20	69%	0	0%
Fruit (sp.)	27	3.6%	7	26%	15	56%	5	19%	0	0%
White ash	26	3.5%	3	12%	14	54%	6	23%	3	12%
Hemlock	19	2.6%	5	26%	13	68%	1	5%	0	0%
Gray birch	12	1.6%	2	17%	6	50%	3	25%	1	8%
Arborvitae	10	1.3%	0	0%	10	100%	0	0%	0	0%
Black locust	6	0.8%	0	0%	5	83%	1	17%	0	0%
Chinese elm	5	0.7%	0	0%	4	80%	1	20%	0	0%
White poplar	4	0.5%	0	0%	0	0%	2	50%	2	50%
Dogwood	4	0.5%	0	0%	3	75%	1	25%	0	0%
Boxelder	3	0.4%	0	0%	0	0%	1	33%	2	67%
American elm	3	0.4%	0	0%	2	67%	1	33%	0	0%
Cherry (sp.)	3	0.4%	1	33%	1	33%	0	0%	1	33%
Japanese maple	2	0.3%	2	100%	0	0%	0	0%	0	0%
Mt. ash	2	0.3%	0	0%	2	100%	0	0%	0	0%
Hickory	2	0.3%	0	0%	2	100%	0	0%	0	0%
Tulip tree	2	0.3%	0	0%	2	100%	0	0%	0	0%
Little leaf linden	2	0.3%	1	50%	1	50%	0	0%	0	0%
Red cedar	2	0.3%	1	50%	1	50%	0	0%	0	0%
Trembling aspen	2	0.3%	1	50%	1	50%	0	0%	0	0%
Amer. Hornbeam	2	0.3%	0	0%	1	50%	1	50%	0	0%
River birch	1	0.1%	0	0%	1	100%	0	0%	0	0%
Large tooth pop.	1	0.1%	1	100%	0	0%	0	0%	0	0%
Honey locust	1	0.1%	1	100%	0	0%	0	0%	0	0%
Black walnut	1	0.1%	0	0%	1	100%	0	0%	0	0%
White fir	1	0.1%	0	0%	1	100%	0	0%	0	0%
Purple leaf plumb	1	0.1%	0	0%	1	100%	0	0%	0	0%
Red mulberry	1	0.1%	0	0%	1	100%	0	0%	0	0%
Catalpa	1	0.1%	1	100%	0	0%	0	0%	0	0%
European birch	1	0.1%	0	0%	0	0%	0	0%	1	100%
Totals	744		132		357		207		48	
	100%		17.7%		48.0%		27.8%		6.3%	

OUTER NEIGHBORHOODS: NUMBERS OF TREES BY SPECIES AND CONDITION

Species	# Trees	% Species in Area	#Excellent	%Excellent	#Good	%Good	#Fair	%Fair	#Poor	%Poor
Red maple	255	15.1%	42	16.5%	147	57.6%	58	22.7%	8	3.1%
Spruce (sp.)	209	12.4%	101	48.3%	88	42.1%	20	9.6%	0	0.0%
Norway maple	203	12.1%	71	34.8%	81	39.7%	33	16.2%	19	9.3%
Arborvitae	133	7.9%	54	40.6%	74	55.6%	4	3.0%	1	0.8%
Fruit (sp.)	101	6.0%	32	31.7%	51	50.5%	18	17.8%	0	0.0%
Red oak	89	5.3%	28	31.5%	50	56.2%	9	10.1%	2	2.2%
Silver maple	58	3.4%	11	19.0%	28	48.3%	16	27.6%	3	5.2%
Black locust	45	2.7%	27	60.0%	17	37.8%	1	2.2%	0	0.0%
Sugar maple	43	2.5%	8	18.6%	24	55.8%	8	18.6%	3	7.0%
Cherry (sp.)	43	2.5%	3	7.0%	35	81.4%	3	7.0%	2	4.7%
White pine	43	2.5%	11	25.6%	28	65.1%	3	7.0%	1	2.3%
White oak	38	2.2%	16	42.1%	19	50.0%	2	5.3%	1	2.6%
Dogwood	33	2.0%	9	27.3%	20	60.6%	4	12.1%	0	0.0%
White birch	32	1.9%	14	43.8%	12	37.5%	4	12.5%	2	6.3%
Fir (sp.)	32	1.9%	4	12.5%	25	78.1%	3	9.4%	0	0.0%
Scotch pine	26	1.5%	1	3.8%	22	84.6%	1	3.8%	2	7.7%
American elm	28	1.7%	4	14.3%	21	75.0%	2	7.1%	1	3.6%
White ash	28	1.7%	5	17.9%	16	57.1%	6	21.4%	1	3.6%
Flowering crab	23	1.4%	1	4.3%	11	47.8%	11	47.8%	0	0.0%
Hemlock	21	1.2%	6	28.6%	7	33.3%	6	28.6%	2	9.5%
Red cedar	18	1.1%	10	55.6%	6	33.3%	1	5.6%	1	5.6%
Boxelder	18	1.1%	1	5.6%	8	44.4%	8	44.4%	1	5.6%
Allanthis	18	1.1%	2	11.1%	12	66.7%	1	5.6%	3	16.7%
Grey birch	17	1.0%	6	35.3%	8	47.1%	3	17.6%	0	0.0%
Red pine	16	0.9%	6	37.5%	4	25.0%	4	25.0%	2	12.5%
Trembling aspen	15	0.9%	13	86.7%	1	6.7%	1	6.7%	0	0.0%
Willow (sp.)	13	0.8%	0	0.0%	2	15.4%	11	84.6%	0	0.0%
Catalpa	12	0.7%	1	8.3%	8	66.7%	3	25.0%	0	0.0%
Little leaf linden	11	0.7%	3	27.3%	6	54.5%	2	18.2%	0	0.0%
Black birch	6	0.4%	0	0.0%	4	66.7%	0	0.0%	2	33.3%
Pin oak	6	0.4%	1	16.7%	4	66.7%	1	16.7%	0	0.0%
Hop hornbeam	4	0.2%	0	0.0%	4	100.0%	0	0.0%	0	0.0%
Red bud	4	0.2%	2	50.0%	0	0.0%	2	50.0%	0	0.0%
Magnolia	4	0.2%	3	75.0%	0	0.0%	1	25.0%	0	0.0%
Juniper	3	0.2%	1	33.3%	0	0.0%	1	33.3%	1	33.3%

CONTINUED...

OUTER NEIGHBORHOODS: NUMBERS OF TREES BY SPECIES AND CONDITION **CONTINUED**

Species	# Trees	% Species in Area	#Excellent	%Excellent	#Good	%Good	#Fair	%Fair	#Poor	%Poor
Honeylocust	3	0.2%	0	0.0%	1	33.3%	2	66.7%	0	0.0%
Hydranga	3	0.2%	0	0.0%	2	66.7%	0	0.0%	1	33.3%
Green ash	2	0.1%	0	0.0%	0	0.0%	2	100.0%	0	0.0%
Hickory	2	0.1%	0	0.0%	2	100.0%	0	0.0%	0	0.0%
Large tooth pop.	2	0.1%	0	0.0%	0	0.0%	2	100.0%	0	0.0%
Horse chestnut	2	0.1%	1	50.0%	1	50.0%	0	0.0%	0	0.0%
Hybrid elm	2	0.1%	0	0.0%	0	0.0%	2	100.0%	0	0.0%
Hawthorne	2	0.1%	0	0.0%	2	100.0%	0	0.0%	0	0.0%
Amer. hornbeam	2	0.1%	0	0.0%	2	100.0%	0	0.0%	0	0.0%
Purple leaf plum	2	0.1%	2	100.0%	0	0.0%	0	0.0%	0	0.0%
Scarlet oak	2	0.1%	0	0.0%	1	50.0%	1	50.0%	0	0.0%
Basswood	1	0.1%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Sycamore	1	0.1%	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Mt. ash	1	0.1%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
European larch	1	0.1%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Japanese maple	1	0.1%	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Austrian pine	1	0.1%	1	100.0%	0	0.0%	0	0.0%	0	0.0%
European birch	1	0.1%	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Tulip tree	1	0.1%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Ornament. maple	1	0.1%	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Yew	1	0.1%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Pignut	1	0.1%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Russian mulberry	1	0.1%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Totals	1685		505	30.0%	858	50.9%	263	15.6%	59	3.5%
%	100%									

OUTER NEIGHBORHOODS: CONDITION, SPECIES, # TREES, DBH

Species	1-8 inches			9-16 inches			17-24 inches			25-32 inches			32+ inches			Fair	Poor	#trees/rc	%Species
	Exc.	Good	Poor	Exc.	Good	Poor	Exc.	Good	Poor	Exc.	Good	Poor	Exc.	Good	Poor				
Red maple	22	48	6	8	43	16	2	7	35	25	5	3	13	6	2	2	255	14.9%	
Spruce (sp.)	51	30	7	29	42	11	2	20	13	2			3				209	12.2%	
Norway maple	36	25	6	30	31	14	5	4	19	10	6	1	3	3	2		204	11.9%	
Arborvitae	45	72	2	5	2	2			2	1							133	7.8%	
Fruit (sp.)	28	33	25	2	8	4			1								101	5.9%	
Red oak	17	30	6	3	7	6	2	2	4	2			4	3	2		89	5.2%	
Silver maple				2	1	3		4	15	5	1	3	6	6	2		58	3.4%	
Black locust	17	7	1	9	10			1									45	2.6%	
Sugar maple	2	1	2	3	6	4	1	2	10		1	1	6	2			43	2.5%	
Cherry (sp.)	3	22	2		11	1	1						1				43	2.5%	
White pine	2	14	1	1	6	1	1	5	3	1		1	1	1			43	2.5%	
White oak	2	7	2	7	2	2		1	8	1		2	1		4		38	2.2%	
Dogwood	8	20	3		1											1	33	1.9%	
White birch	13	8	3	1	2	1	1		2								32	1.9%	
Fir (sp.)	4	23	3		2												32	1.9%	
American elm	3	12			5		1		3			1	1	2			28	1.6%	
White ash	4	8	3	1	1	1	1		6	2							28	1.6%	
Scotch pine		14			8		1	1									26	1.5%	
Flowering crab		10	9	1	1	2										1	23	1.3%	
Hemlock	5	2	3	1	3		1		2	3	1						21	1.2%	
Red cedar	6	4	1	2	2			2									18	1.1%	
Boxelder		6	2		1	3				1	1	1	1	1			18	1.1%	
Ailanthis	1	4		1	4				1	1			3				18	1.1%	
Grey birch	5	3		1	5	2	1										17	1.0%	
Red pine	4		4	4	1	3											16	0.9%	
Trembling aspen	12	1		1													15	0.9%	
Willow (sp.)			5		1	3			1	1			2				13	0.8%	
Catalpa	1	3			2	2			1	1			1	1			12	0.7%	
Little leaf linden		3	2	3	2								1				11	0.6%	
Black birch		4					2										6	0.4%	
Pin oak		4	1	1													6	0.4%	
Hop hornbeam		1			2				1								4	0.2%	
Red bud	2					2											4	0.2%	
Magnolia	2			1						1							4	0.2%	
Juniper	1					1											3	0.2%	
Honeylocust		1	2														3	0.2%	
Hydranga		2															3	0.2%	
Hickory																	2	0.1%	
Green ash						2					2						2	0.1%	

CONTINUED...

